B I D D I N G D O C U M E N T

for

The Work of Design, Engineering, Construction and Commissioning 10 MLD Sewage Treatment Plantwith Biological Nutrient Removal (BNR) at Anjanapura-2 BDA layoutwith 10 MLD TSPS, Pumping Main and Operation & Maintenance for Seven Years.
(DBO contract)

Contract Package – BWSSB -ANJ-2- BDA

National Competitive Bidding (NCB)

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PART 3

GENERAL REQUIREMENTS

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PART 3

GENERAL REQUIREMENTS

3.1 Introduction

This Part sets out the technical requirements that are general to the Contract.

3.2 Technical Standards and Regulations

Except where otherwise specified in the bid document plant, materials and workmanship shall comply with the requirements of the relevant Indian Standards (hereinafter referred to as IS) issued by the Bureau of Indian Standards. Other equivalent National or International Standard Specifications such as those issued by the International Organisation for Standardisation (ISO) or the International Electrotechnical Commission (IEC) may be substituted by the Contractor (soas long as they are more stringent than the equivalent IS) at the sole discretion of the Engineer or as may have been agreed in the Contract. All standards used shall be the current and latest version.

The Electrical installation shall comply with all relevant statutory regulations and standards current at date of bids, unless otherwise indicated within the Employer's Requirements. Electrical installations shall, where relevant, be in accordance with the Indian Standards Code of Practice for Electrical Wiring Installations IS 732.

All materials, plant and equipment shall be new and all materials and workmanship not fully specified herein or covered by an approved standard shall be of such kind as is used in first class work and suitable to the climate in the project area.

Where reference is made in the Specification to a British Standard Specification (hereinafter abbreviated to `B.S.') issued by the British Standards Institution of 2, Park street, London W.I., or to an Indian Standard Specification (I.S.) issued by the Bureau of Indian Standards, (earlier known as Indian Standards Institution), ManakBhavan, 9 Bahadur Shah ZafarMarg, New Delhi 110 002, or American Society for Testing and Materials (ASTM) issued by ASTM 1916 Race Street, Philadelphia, P.A., 19103, U.S.A. or American National Standards Institute (ANSI) issued by ANSI 1430, Broadway, New York, N.Y., 10018, U.S.A. or Japanese Industrial Standards (JIS) issued by Japanese Standards Association, 4-1-24, Akasaka, Minato-Ku, Tokyo 107, Japan or to any other equivalent Standard it shall be to the latest revision of that Standard at the Tender opening date.

The Contractor may propose, at no extra cost to the Employer, the use of any relevant authoritative internationally recognised Reference Standard, including Indian Standard (IS) and Japanese Industrial Standards (JIS).

All details, materials and equipment supplied, and workmanship performed shall comply with these Standards. If the Bidder offers equipment to other Standards, the equipment/material should be equal or superior to those specified and shall be subject to approval by the Engineerand full details of the difference shall be suppliedby the Contractor.

In the event of conflict between this Specification and the Codes for equipment, the most stringent provision shall govern, except as otherwise approved by the Employer. Certain Specifications issued by national or other widely recognised bodies are referred to in this Specification. Such specifications

shall be defined and referred to hereinafter as Standard Specifications. In referring to the Standard Specifications the following abbreviations are used:

IS	:	Indian Standard
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society of Testing and Materials
AWS	:	American Welding Society
AWWA	:	American Water Works Association
ISO	:	International Organization for Standardization
JIS	:	Japanese Industrial Standard
DIN	:	Deutsches Institute fur Normung
BS	:	British Standard
JWWA	:	Japanese Water Works Association
IEC	:	International Electrotechnical Commission
IEE	:	Institution of Electrical Engineers
IEEE	:	Institute of Electrical and Electronic Engineers
NEMA	:	National Electrical Manufacturers Association
AGMA	:	American Gear Manufacturer's Association

3.3 Precedence of Employer's Requirements

The Requirements specified in the Particular Requirements parts, shall be in addition to those specified in the General Requirements parts. In case of conflict between the parts, the requirements of the Particular Requirements parts shall take precedence.

3.4 Units of Measurement

All designs, drawings, specifications and manuals shall use SI units and all measurements, dimensions and performance data shall be quoted in those units.

3.5 Programme

In accordance to Sub Clause 8.3 of the Particular Conditions of Contract, the Contractor shall submit within in the stipulated time detailed contract programme for approval, which shall include details of all temporary and permanent works, construction procedures and methodologies.

In addition to the requirements set down in the Conditions of Contract the programme shall include the following details:

(a) Contractor's organisational family tree for the Contract including details of all site supervisors and their responsibilities.

(b) A statement giving the numbers and categories of supervisory and technical staff and skilled and unskilled labour to be employed on the Works.

(c) A list and type details of major constructional plant (including vehicles) which the Contractor proposes to employ on the Works, including programmed dates for order and delivery.

(d) Details of the Contractor's methods of working for all operations.

(e) A statement giving the proposals for location or locations and sizes of offices, workshops and stores at the Site.

(f) A complete resource allocation showing the number of units and allotted times for each unit of constructional plant, materials and labour allocated to each part of the Works.

The programme shall be co-ordinated to take into account the requirements of climatic, groundwater and other conditions to provide for the completion of the Works in accordance with the Contract.

The programme shall be prepared using MS Project software and shall be submitted on both soft copy(editable copy)and paper.

3.6 Contract Management

The Contractor shall be responsible for administration of the Contract from award of Contract through design, manufacture, manufacturer's works testing, and delivery of Plant to Site, installation, testing and performance testing to final take over. For this purpose he shall nominate a Contractor's Representative in accordance with Sub-clauses of the General Conditions of Contract who shall be fully responsible for and undertake this administration.

Specific responsibilities of the Contractor's Representative shall be:

(a) The sole representation on behalf of the Contractor in all discussion, correspondence and matters relating to the Works.

(b) The co-ordination and monitoring of Contract progress, which shall include the preparation of the Contract programme, monitoring of progress and submission of monthly progress reports. At the discretion of the Engineer, regular meetings shall be called at which the Contractor's Representative shall give a full account of the Contract progress and programme.

(c) The co-ordination and checking of designs, drawings and submissions. The Contractor's Representative shall be responsible for co-ordinating the design, technical information and data between Sub-Contractors. All calculations, drawings and information submitted to the Engineer shall be checked by the Contractor's Representative and certified as having been checked before submission.

(d) Contract communication between the Engineer and the Contractor. The Contractor's Representative shall attend all meetings involving the Contractor and the Engineer.

(e) The Co-ordination and programming of manufacturer's works tests and the submission of test certificates.

(f) The co-ordination and programming of Plant delivery.

(g) The co-ordination and programming of the installation of Plant on the Site, site tests and take over trials. The Contractor's Representative, although not necessarily based at the Site, shall be responsible for the various sub-contractors. At the discretion of the Engineer regular site meetings will be held during which the Contractor's Representative shall give full account of site progress and programme.

(h) The Contractor's Representative shall also be responsible for producing in advance of the work being undertaken, detailed method statements of any work, which involves or affects the performance of existing equipment, processes, or disruption to existing water supplies.

(i) The co-ordination and preparation and submission of As-Built Drawings and Operation and Maintenance Manuals.

(j) Soft copies of all submissions should be in editable form by word, excel, pdf and AutoCAD2020.

(k) The preparation and co-ordination of training of Employer's Personnel.

(l) The submission of applications for payment.

3.7 Meetings

From time to time the Engineer will call meetings in his office or at the Contractor's office, or at the Site, as he deems necessary, to discuss progress and any technical points requiring settlement.

The Contractor's Representative or responsible representative shall attend such meetings.

The Contractor shall prepare and submit to the Engineer a daily activity report summarising the main activities undertaken each day. As well as problems in design and construction, safety management information, progress of construction by S-Curve Chart.

3.8 Site Photographs

In accordance with the requirements of the Conditions of Contract the Contractor shall supply soft copies of photographs and unmounted positive colour prints not less than 150mm x 100mm of such portions of the Works, in progress and completed, as may be directed by the Engineer and specified herein. The soft copies and prints shall not be retouched. The soft copy of each photograph shall be the property of the Employer and shall be delivered to the Engineer with the prints. No prints of these soft copies shall be supplied to any other person without the written permission of the Engineer.

The photographs shall be of three categories:

- Original/Before construction
- Progress Photographs
- Record Photographs

The above categories of photographs shall be properly referenced to the approval of the Engineer, and on the back of each print shall be recorded the date and time of the photograph, the direction in which the camera was facing, an identifying description of the subject and the reference.

Photographs taken for record purposes as ordered by the Engineer or as specified herein shall be supplied with soft copy and three prints, having the reverse of one superscribed with the signatures of the Contractor and the Engineer (or their authorised representatives) for the purpose of attestation. If required, the Contractor may at his own expense have an additional print similarly attested for his retention.

The Contractor shall supply one soft copy and three prints dated with description of each progress photograph ordered by the Engineer. The Contractor shall supply two additional prints dated with description of progress photographs selected by the Engineer for incorporation in albums. The Contractor shall supply two sets of albums, mount the prints, and title the prints and albums all to the approval of the Engineer.

The taking of photographs of the Works by the Contractor for any other purpose whether for use in India or in any other country shall not be carried out without written approval from the Engineer.

3.9 A) Setting Out of the Works

The contractor shall receive engineer's instructions for reference points and elevation points as benchmark.
The Contractor shall set out the Works and carry out the Contractor's quality control procedures verifying the accuracy and precision of the setting out for each item of the works. The Contractor shall notify the Engineer sufficiently in advance of the setting out to enable the Employers Representative to observe the accuracy and precision of the laying out. The observations of the Engineer shall not relieve the Contractor of the responsibility under the Contract for the accuracy and precision of the setting out.

The Engineer shall approve dimensioned drawings, levels and other information necessary to enable the Contractor to set out the Works, at his own cost. The contractor shall provide all instruments such as theodolite, total station, leveling instruments in good working condition. The contractor shall also provide pegs, ranging rods, long measuring rods, marked meters and decimeters and each meter and decimeter numbered, posts and sight-rails, boning rods, moulds, template etc., together with any reasonable number of laborer that may be required and set out the Works and be responsible for the accuracy of the same. The Contractor shall amend at his own cost and to the satisfaction of the Engineer any error found at any stage which may arise through inaccurate setting out unless such error is based on incorrect data furnished in writing by the Engineer. The Contractor shall protect and preserve all control points and benchmarks used in setting out the Works till the end of the Defects Liability Period unless the Engineer directs its early removal. The Contractor should also keep the theodolite and leveling instruments in good working condition throughout the period of construction work on site.

The checking of any setting out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

No separate payment will be made for setting out the Works as required. Unit rates quoted by the Contractor for all items will be deemed to have covered the expenses for such setting out.

B) Details and Data made available by Employer

The Employer has the following data available and used these in formulation of the bid elements. They are listed below and shall be used only as guideline. The Employer does not, however, guarantee either the sufficiency or accuracy of the data provided. Contractor shall carry out fresh survey, investigation and particular testing/and all other details necessary for proper planning, detailed design and execution. The Contractor will be required to provide full details of the investigations and analysis for approval of the Engineer.

- Layout Plan of STP &Access Road
- Boundary

3.10 Engineer's Requirements

The Contractor shall provide the following for use by Engineer at the each proposed STP plant sites covered under the contract. These items are to be maintained by the Contractor in proper, safe, and clean working condition throughout the construction period.

(a) Engineer's Staff Site Office

(b) First Aid

(c) UPS

(d) Domestic water

3.10.1 Engineer's Staff Site Office

A separate office(PORTA CABIN), with toilet facilities for the sole use of the Engineer, his staff and Consultant shall be provided by the Contractor at STPsite. The Contractor shall provide, erect, furnish, clean, maintain and subsequently transfer the associated furniture/items to the Employer after the completion of works.

The location of the office shall be as directed by the Engineer.

The Engineer's staff office shall be ready in all respects within 60 days after Contractor takes possession of the site. The Office shall be maintained throughout the construction period with office help staff, power, water, sewerage, and housekeeping. These amenities shall be arranged by the Contractor either with the available resources or from independent sources (e.g. diesel generator sets, borewells, etc.) at his own cost.

The equipment, furniture, and furnishings shall include: atSTP

(a) 4Nos. of 4' x 2 ½' table with drawers on both sides (3 on each side)

(b) 2 Nos. of 3' x 2' table with single side three drawers

(c) 10Nos Chairs (approved make)

(d) Conference table of 12 sitters.

(e) LAP TOP (with high end specification as mentioned below) with basic installed software like MS Office, Autocad & Staddpro, Antivirus & Malware software.

Make	HP / Dell / Lenovo
Quantity	1 No.
CPU	Intel Core I7, 4 GHz or Latest available at the time of supply.

DDR RAM	8 GB DDR4 RAM (slot for 1 No. additional RAM slot should be provided)
Hard disk	1 TB
Storage medium	DVD R/W drive
VDU	17" FHD Screen with wide angle viewing with better resolution.
Integrated	10/100/1000 Mbps Ethernet LAN interface card IEEE 802.11B connectivity port (It shall be possible to connect the laptop to the Ethernet switch provided in the respective location. Necessary port shall be provided in the Ethernet switch)
Communication ports	One serial, one parallel, min. four USB ports, blue tooth & WIFI enabled, minimum one Ethernet port, internal modem required.
Mouse	Optical mouse & Touch pad
Power supply	Universal AC adapter: 100 to 240 V AC (50 Hz) input; Battery required with minimum 8 hrs battery backup.
Speakers	Required. The Laptop shall be provided with necessary sound cards & drivers.
Any other features	All standard features available on a laptop.
Cables & accessories required for connecting to Ethernet Switch	Required.
Software to be loaded	Windows-10 or latest Operating System Software, MS office 2010, Latest version of Adobe Acrobat read/write software. Latest version of anti-virus kit shall be provided with license for 3 year up gradation. (Refer Note-9)
Recovery/ Backup CD/DVDs / other suitable non-volatile storage medium	
Required for all the specified software & drivers for servers, Workstations, engineering station, Laptop	

- HP Colour LaserJet Printer (suitable for A4/A3 size paper) or equivalent
- All the necessary consumables including paper, CDs, printer cartridges etc.

(f) Fire Extinguisher – CO_2 type (3 Kg) – 4 sets (min).

(g) Cellphone with SIM for contract period - 1 no and High Speed Broadband with running costs to be borne by contractor throughout the contract period.

(h) First Aid

(i) Domestic water
(j) Toilet

No separate payment shall be made for the items covered here

3.10.2 Vehicles

For the above Contract the firm has to provide 01 No. of new INNOVA or equivalent (capital cost of INNOVA vehicle will be reimbursed at actual cost under provisional sum). The vehicle to be kept available at all times for the sole use of the Engineer and his staff. The driver consumables, Insurance tax etc at no additional cost till end of contract (after successful completion of O &M period) shall been borne by contractor. And handover the vehicle to the designated officers of the Board after completion of the project in good working condition

3.10.3 Assistance to the Engineer

The Contractor shall provide all necessary assistance to the Engineer and his staff in carrying out their duties of checking, inspecting, and measuring the Works. The Contractor shall provide, at no additional cost, chainmen, staff men, office attendants, and labourers as may be needed from time to time by the Engineer.

The Contractor shall provide for the Engineer and his staff, consultants and their staff and visitors such protective clothing, safety helmets and rubber boots of suitable sizes, hand lamps and the like as may be reasonably required by them. These articles shall remain the property of the Contractor. No extra payment shall be made on this account.

3.11 Erection of Plant

Erection of Plant shall be phased in such a manner as not to obstruct the work being done by other contractors.

Before commencing any erection work, the Contractor shall check the dimensions of structures where the various items of Plant are to be installed and shall bring any deviations from the required positions, lines or dimensions to the notice of the Engineer.

Plant shall be erected in a neat and workmanlike manner on the foundations and at the locations shown on the Approved Drawings. Unless otherwise directed by the Engineer, the Contractor shall adhere strictly to the aforesaid drawings.
The Contractor shall be responsible for setting up and erecting the Plant to the line and level required and shall ensure that all Plant is securely held and remains in correct alignment before, during and after grouting-in. This responsibility shall not be passed to any other contractor.

Any damage caused by the Contractor during the course of erection to new or existing plant or building or any part thereto, the Contractor shall at his own cost, make good, repair or replace the damage, promptly and effectively as approved by the Engineer and to the Engineer's satisfaction.

3.12 Site Labour and Supervision

The Contractor shall provide all the skilled and unskilled labour required, and all necessary tools and equipment, to erect, test and commission the Works within the period agreed in the programme.

The Contractor shall not remove any supervisory staff or skilled labour from the Site without the Engineer's prior approval.

3.13 Sub-letting

The Contractor shall not sub-let the whole of the Works. Where any design or manufacture is sub-let, the Contractor shall not be relieved of his obligation under the Contract. The Contractor shall be responsible for the acts, defaults and neglect acts in manufacture or design of any Sub-Contractor, as if they were his own.

Where the Engineer has consented to supply of Plant equipment or execution of work by manufacturers or sub-contractors proposed by the Contractor, such manufacturers or sub-contractors shall not be changed without the prior approval in writing of the Engineer.

A copy of every sub-order shall be sent to the Engineer at the time the order is placed each clearly marked with the title of the Contract and the Contract number.

3.14 Temporary Works

Not less than 14 days before commencing any portion of the Works, the Contractor shall submit to the Engineer for his approval comprehensive drawings and calculations for all Temporary Works which the Contractor proposes for the construction of that part of the Works.

Notwithstanding approval by the Engineer of any design for the Temporary Works, the Contractor shall be entirely responsible for their safety, efficiency, security, and maintenance and for all obligations and risks in regard to such Temporary Works specified or implied in the Contract.

3.15 Languages

All drawings, instructions, signs, notices, name-plates, etc. for use in the design, construction, operation and maintenance of the Works shall be in English.

All site sign boards and warning signs shall be in KannadaandEnglish Languages.

3.16 Drawings and Information to be Provided

3.16.1 General

The drawings that will be prepared and issued for this Contract shall be classified as follows and where relevant shall be to a scale which is suitable for the representation of those details illustrated.

The term Drawing shall be deemed to include all drawings, schedules, lists, software documentation, descriptive text and calculations necessary for the design, construction, operation and maintenance of the Works and referred to in this clause.

Drawings and all other submittals required during bidding stage and after award ofContract shall be submitted in editable electronic softcopy format on CD(s) or DVD(s) as well as in hardcopy paper format.The Contractor shall submit plan and levels of the, incoming sewers/Rising mains, STPs in

soft copies and six hard copies to the client for approval. The approved soft copy of the sewer network drawings shall be provided to the contractor for correction and submission of required numbers of hard copies of the drawings.

The softcopy format for various items shall be as follows:

- Drawings: AutoCAD version 2020
- Text Documents: Microsoft Word version 2019and above including Microsoft Project
- Spreadsheets, Hydraulic design/capacity/power calculations, tables, technical schedules, prices schedules, and other numerical data: Microsoft Excel version 2019and above
- All other required information not included in the above: Adobe Portable Document Format (PDF) version 7.x

The hardcopy format/sizes for various items shall be as follows:

- Drawings: Standard A1 size paper. The scale for each drawing shall be selected such that the information is presented without any clutter or ambiguity and is clearly and easily legible without the use of magnifying aids other than a reader's normal eye-glasses.
- All other information: Standard A4 or A3 paper size, except for any pre-printed standard information such as brochures or catalogue information, which may be submitted in the original size and format.

3.16.2 Drawing Format and Numbering

All drawings shall be prepared using an identical title block format. This shall be approved by the Engineer and shall identify the project, drawing title, the Employer, the Contractor, Sub-contractor, if applicable, and the Engineer.

A formalised drawing numbering system shall be adopted with digits of each number, referencing location, revision, drawing type and size. The numbering format and allocation of drawing number blocks shall be approved by the Engineer.

The Contractor shall provide a sequential numbering system for all Construction Documents. The drawing number shall not be repeated or duplicated.

All drawings shall be submitted to a formalised checking procedure prior to submission. Drawings not so checked will not be approved.

3.16.3 Pre-contract Drawings

The Pre-contract Drawings are those issued to Bidders either with the Bidding Documents for the purpose of illustrating and clarifying the Works described in the Employer's Requirements or later during the bidding period as part of an Addendum to the Contract Documents.

Such drawings shall be deemed to have been issued for the guidance of Bidders and shall, for the purpose of executing the Works, be superseded by the Construction Documents.

3.16.4 BidDrawingsand Details

The Bid Drawings are those furnished by a Bidder with his Bid for the purpose of illustrating and clarifying his proposals.

The following drawings, details and specific information pertaining to the entire sewage treatment process / plant /Pumping main, Sewer network (if required as per site condition) shall be furnished by the Bidder in the technical envelope in addition to other information mentioned elsewhere in the tender.

The lists provided below shall not be considered comprehensive. The bidder shall be responsible for all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The bid drawings and other technical documents shall be submitted in soft copy format on CD(s) or DVD(s) as well as in hardcopy paper format.

(a) General and Process

(i) Narrative Description of the Works.
(ii) Plant Operation and Control Philosophy.
(iii) Sizing and Design Calculations covering all Major Unit Processes and components of the Works.
(iv) List of all structures (basins, tanks, channels, buildings, etc.) including dimensions and freeboards.
(v) Complete Equipment List.
(vi) Plant Layout.
(vii) Hydraulic Profile.
(viii) Process Flow Diagram.
(ix) Process and Instrumentation Diagrams (P&IDs)
(x) Electrical Load List& Power Consumption Chart.
(xi) List of Chemical Consumption on Daily/ Monthly Basis.

(b) Mechanical

(i) To-scale dimensional layout and/or installation drawings for the following Equipment, at a minimum:
- Raw Sewage Pump sets
- Submersible Mixers for Anaerobic and Anoxic zones (Extended Aeration system)
- Fine Bubble Diffusers (fixed/retrievable)
- Chlorination system
- Sludge collector/Scum skimmer/Grit washer etc.

(ii) Graphs for all major pumps and blowers (including but not limited to Raw Sewage Pumps, Primary Sludge Pumps, Return Activated Sludge Pumps, Mixed Liquor Recycle Pumps, Thickened Sludge Pumps, Centrifuge Feed Pumps, Process Air Blowers,Pump Performance Curves: Q vs H, speed, P, Efficiency, and NPSH

(c) Efficiency curves of the pump model proposed

(i) Electrical Single Line Diagram.
(ii) Sizing Calculations for Transformers and DG Set.
(iii) Specific Energy Consumption.
(iv) TechnicalSchedules for Electrical Works duly filled in.
(v) Instrumentation SCADA.
(vi) Construction schedule.

3.16.5 Details of Drawings and Calculations to be submitted by the Contractor for Approval

Drawings / Calculations for approval shall be submitted by the selected Contractor after award of the contract in two Stages.

The first phase shall be the Preliminary Drawings / Designs. Drawings / Designs submitted during this phase shall be of sufficient detail for the Employer and Engineer to understand in outline the Contractor's proposals for the design and construction of the Works.

The Preliminary Drawings / Designs for TSPS and STP with associated pumping mainshall inter alia comprise:

- Detailed Description of the proposed Sewage Treatment Plant and Treatment Process offered (including Raw and Treated Sewage Quality).
- Detailed Plant Operation and Control Philosophy.
- Detailed Process Design Calculations / Mass Balance Calculations covering all Units/ Equipment.
- Detailed List of Units including Unit Dimensions/ Free Boards.
- Detailed Equipment List.
- Major Equipment /Instrument Specifications (with supporting Brochures).
- Major Piping Schedule to include size, material, coating, lining, gauges/thickness, and pressure rating.
- Major Valve Schedule to include size, type, material, pressure rating, operator/actuator type, and whether Open/Close or Modulating.
- Gate Schedule to include size, type, differential head, seating or unseating, operator/actuator type, and whether Open/Close or Modulating.
- Detailed Plant Layout (including Pipe Sizes/ Pipe Routing/ Channel Size/ Channel Routing/ Site Roads/ Site Drainage/each processing facilities).
- Detailed Hydraulic Profile including Hydraulic Calculations.
- Detailed Process Flow Diagram (inclusive of Mass Balance).
- Process and Instrumentation Diagram (P&ID) and SCADA.
- Detailed Chemical Consumption Calculations (Daily/ Monthly Basis).
- Transformer sizing calculation for STP based on approved Electrical load list.
- D.G sizing calculation for STP based on approved Electrical load list.
- Full Hazardous Area Classification Analysis and Report per IS 5572 for STP in the contract.
- Hazardous Area Classification Drawings per IS 5572 for STP in the contract.
- Design Concept Report for Electrical Equipment includes total power consumption.

The second stage shall be the Detailed Engineering Design phase and shall comprise the submission of the Detailed Mechanical/ Electrical/ Instrumentation/ SCADA/ Structural/ Civil Construction Drawings and Calculations. These shall be submitted after the approval of the Preliminary Drawings. The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full

and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The Construction Documents shall be used for the construction of the Works and shall inter alia comprise:

(a) Civil

Site layouts forSTP providing information on levels and detailing the location of:

- General arrangements and main sections of all plant areas.
- Plans, elevations and main sections of all structures and buildings.
- Buildings.
- Storage tanks.
- Process plants.
- Transformer enclosures.
- Roadways.
- Drainage (plant drainage, sanitation and storm water drainage).
- Buried pipelines.
- Cable routes for direct in ground and ducted systems.

Detailed drawings for Rising mainbased on soft copies provided

- Survey, Plans, L-Sections of Rising Main

Detail drawings of:

- Cable and pipework chambers.
- Buried pipework.
- Pipework connections.
- Contract interface.
- Reinforcement drawings.
- Bar bending schedules.

Calculationsfor:

- Detailed Structural Design calculation of all the units/ Structures.
- Detailed design of Rising main including the calculation of diameters.

(b) Hydraulic

-Detailed hydraulic profile (STP, sewer network/Pumping Main& discharge pipe).
-Detailed hydraulic calculations (STP, sewer network/Pumping Main& discharge pipe).
-Plan and L-Section profile of Pumping Main.

(c) Process

Drawings:
-Process flow diagram.
-Comprehensive P&ID s including details of.
-Pipeline sizes and materials.
-Valve size and type.
-Equipment detail.
-Instrumentation.

-Identification of controlling PLC.

Calculations for:

-Detailed Process Design Calculations / Mass Balance Calculations covering all Units/ Equipment.
-Detailed List of Units including Unit Dimensions/ Free Boards.
-Detailed Equipment List.
-Major Equipment /Instrument Specifications (with supporting Brochures).
-Major Piping Schedule to include size, material, coating, lining, gauges/thickness, and pressure rating.
-Major Valve Schedule to include size, type, material, pressure rating, operator/actuator type, and whether Open/Close or Modulating.
-Gate Schedule to include size, type, differential head, seating or unseating, operator/actuator type, and whether Open/Close or Modulating.
-Detailed Process Flow Diagram (inclusive of Mass Balance).
-Detailed Electrical Power Consumption Calculations.
-Detailed Chemical Consumption Calculations (Daily/ Monthly Basis).

(d) Mechanical

Drawings:

Outline dimensional drawing & Cross section Drawing (with Bill of Quantity and Material of construction) for the following items for TSPS and STPs, but not limited to:

1.	Raw Sewage Pumpset
2.	TSPS Coarse screens
3.	Medium screens
4.	ScrewConveyor for screenings
5.	Sluice valve – motorised
6.	Sluice valve – manually operated
7.	Non-Return valves
8.	Knife Gate Valves
9.	Dismantling joints
10.	H.O.T & E.O.T Cranes
11.	Sluice gate – Manual & Motorised
12.	DewateringPumpset
13.	Grit removal equipment/Grit washing equipment
14.	Fine Bubble Diffused Aerators along with Grid
15.	Process Air Blowers
16.	Secondary Clarifier and Scum skimmer
17.	Return activated sludge Pumpset
18.	Submersible Mixers for Anaerobic and Anoxic zones
19.	Chlorination system
20. ‘	Mixed Liquor Internal Recycle Pumps
21.	Return Activated Sludge Pumps
22.	Alum dosing system
23.	Chlorination system
24.	Plant Drain Pumps

25.	Plant Water Pumps
26.	Sludge Dewatering Centrifuges
27.	Gravity Sludge Thickeners (if applicable)
28.	Thickened sludge pump sets
29.	Chemical Dosing Pumps and Agitators
30.	Sludge belt conveyor system & Hopper
31.	Sludge Dewatering Centrifuge Feed Pumps, other equipment.
Graphs for all major pumps and blowers (including but not limited to Raw Sewage Pumps, Primary Sludge Pumps, Return Activated Sludge Pumps, Mixed Liquor Recycle Pumps, Thickened Sludge Pumps, Centrifuge Feed Pumps, Process Air Blowers,): Pump Performance Curves: Q vs H, speed, P, Efficiency, and NPSH Efficiency curves of the pump model proposed	

(e) Electrical

Drawings:

(1) Detailed Electrical Load List for all STP/TSPS prepared based on approved Equipment list from process and Mechanical.
(2) Transformer sizing calculation for all STP/TSPS based on approved Electrical load list.
(3) D.G sizing calculation for all STP/TSPS based on approved Electrical load list.
(4) Single Line Diagram of Complete Electrical System for STP/TSPS based on the equipment finalized by Mechanical and Process.
(5) Electrical Substation Layout of STP/TSPS showing Panel locations, Transformer locations and Trench Layout.
(6) 11kV Switchgears:
    (a) Guaranteed Technical Particulars.
    (b) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.
    (c) Complete assembly` drawings of the Switchgear showing plan, elevation and typical sectional views, details of busbars and location of cable end boxes and control cable terminal blocks for external wiring connections, etc.
    (d) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.
    (e) Single Line Diagram, Schematic power and control wiring diagrams along with control& interlock details, complete bill of materials indicating make, type,rating,setting etc of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc.

(7) Diesel Generator Set
    (a) Guaranteed Technical Particulars.
    (b) GA Drawing showing overall dimensions,plan, elevation, sectional views, mounting arrangement, layout, make,type,ratingetc of diesel engine, Alternator, Control panel, battery, battery charger etc.
    (c) Single Line & Schematic diagrams showing details of Power & Control, AMF details,interlocks, protections, annunciations, battery, battery charger etc with make, type, rating, setting etc of various equipment, components etc.

(d) Foundation plan showing the location of channel sills, foundation, anchor bolts and anchors, floor plans and openings.
(e) Exhaust system with piping layout.
(f) Day oil tank sizing with mounting arrangement details.

(8) 11kV / 433 kV Transformers
(a) Guaranteed Technical Particulars.
(b) General arrangement drawing of the transformer, showing plan, front elevation and side elevation complete with all accessories and fittings, detailed dimensions, net weights, quantity of oil, clearances between HV terminals, between LV terminals, between HV and LV terminals, between HV & LV terminals and ground etc.
(c) Rating, diagram and terminal marking, complete with polarity and vector group.
(d) Control wiring diagram for marshalling box.
(e) Foundation drawing with position of foundation bolts and depth.

(9) L.T Panels, Distribution Boards, Power Control Centres, Power Motor Control Centres, Motor Control Centres etc.
(a) Guaranteed Technical Particulars.
(b) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.
(c) Complete assembly drawings of the switchboard/distribution board / MCC showing plan, elevation and typical sectional, views, details of busbarsandlocation of power &control cable terminal blocks for external wiring connections, etc.
(d) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.
(e) Single Line Diagram &Schematic power and control wiring diagrams along details, complete bill of materials indicating make,type,rating,setting etc of Circuit breakers,relays, contactors, current transformers, potential transformers, instruments, meters,annunciations etc.
(f) Feeder Operation and Interlock logic.

(10) L.T Capacitor bank with Automatic Power Factor Correction Relay
(a) Guaranteed Technical Particulars.
(b) Fully dimensioned general arrangement drawings of capacitor and capacitor control panel with elevation, side view, sectional view and foundation details.
(c) Justification for number of steps for switching.
(d) Single Line Diagram, Schematic and wiring diagrams for capacitor control panel complete with bill of materials.

(11) Variable Frequency Drives/ soft staters drives
(a) Guaranteed Technical Particulars.
(b) Dimensional details with mounting arrangement.
(c) Single Line Diagram & Schematic powerand control wiring diagrams alongdetails, complete bill of materials indicating make, type,rating, setting etc of various equipment /components/items, various equipment /components/items.
(d) Specific details of converter, inverter and harmonic control units.

(12) Battery and Battery Charger with D.C.Distribution board

(a) Guaranteed Technical Particulars.
(b) Dimensioned general arrangement drawings.
(c) Fully dimensioned general arrangement drawings of battery and battery charger with elevation, side view, sectional view and foundation details.
(d) Complete schematic and wiring diagrams with bill of materials.

(13) Non Segregated LT Bus duct

(a) Guaranteed Technical Particulars.
(b) Dimensioned generalarrangement drawings.
(c) Layout drawings with billof materials.

(14) Cabling System

(a) Guaranteed Technical Particulars of HT& LT Power and Control Cables.
(b) Details of Installation of Cables in Trenches, on cable trays, directly buried Etc at all locations inside the plant.
(c) Cable routing plan and section inside the plant.
(d) 11kV Cable termination and mounting Kit Layout drawing.
(e) Datasheets for various cables.

(15) Lighting system

(a) Make,type,rating etc of various fixtures,receptacles, switches etc in various premises.
(b) Make,type,rating etc of various fixtures,lighting poles etc for street lighting and flood lighting.
(c) Detailed Room wise Lighting Layout with Type of fixture details and Circuit diagram showing phase wise load distribution and interconnection between switches, fixtures, Lighting panel, receptacles etc.
(d) Internal road Lighting and Area lighting layout with location of poles,detailsoffixturesand mounting.
(e) Street Light pole details with Foundation details.

(16) Earthing System and lightning Protection

(a) Details such as material, sizes, etc. of the earth conductor and electrode pits.
(b) Earthing layout drawing showing routing of main grid inside the plant with details of interconnection of equipment earthing to the grid and earth pits.
(c) Lightning Protection Layout.

(17) Electrical Equipment and Panel Layout.
(18) Indoor & Outdoor Lighting Layout.
(19) Indoor & Outdoor Cable trench, Cable tray & Cable Layout.

Schedules

(1) Cable schedules & bill of quantities.
(2) Electrical Load and Power consumption schedule.
(3) Protection relay setting schedule.

Calculations

(1) Specific Energy Consumption Calculations.
(2) Bus bar sizing calculation for 11 KV Switchgears, 415 V Switchgears etc.
(3) Co-ordinated protection study as per IS 13234.
(4) Fault level and Voltage Dip Calculations as per IS 13234.
(5) Hormonic Analysis study for VFDs.
(6) Arc Flash Study as per IEEE 1584.
(7) Sizing of Capacitor banks.
(8) Sizing Calculation for Battery and Battery Charger.
(9)Non Segregated Bus Duct.

(a) Sizing of the bus bars vis-à-vis thermal capability to withstand rated Continuous current and one second short time current.
(b) Spacing of the insulators vis-à-vis mechanical strength to withstand forces due to momentary short circuit current.
(c) Heat loss and temperature rise calculations for conductor and enclosure. All formulae and other information from which the heat losses have been derived shall be enlisted.

(10) HT and LT Cable sizing.
(11)Earthing sizing calculation.
(12)Room wise Lighting Calculation as per Lux level given in the specification.
(13)Outdoor Lighting Calculation.
(14) Building Lightning Protection and Earthing Sizing Calculation.

(f) Instrumentation and Control

Drawings:

- Power supply distribution single line and schematics diagrams (see note 1) for each control panel.
- Internal and external (see note 2) general arrangement for each control panel (dimensional).
- Control panel wiring diagram, relay logic diagram along with terminal block details.
- System configuration including communication with remote monitoring from central SCADA stations.
- And layout diagram along with bill of material, program listings, block logic diagram and control logic write up for PLC.
- UPS and battery sizing calculations.
- Control and instrumentation loop drawings (see note 3).
- Instrument installation detail drawing (hook up, see note 4).
- Cableblock diagrams.
- Cable routing/installation drawings.
- Foundation and fixing details and trenches drawings.
- Mimic general arrangement (full colour copies shall be provided).

Schedules:

- Cable schedule.
- Cable interconnection schedule.
- Control and instrumentation load schedule for each control panel.
- I /O schedule.
- Junction box schedule.
- Instrument schedule with make, model &tag nos.
- Instrumentation, process control set point schedule.
- Instrument data sheets.

- Spares Summary.

Documentation:
- Document Control Index.
- Functional design specification (FDS)- Instrumentation & Automation.
- Bill of Materials Database.
- Factory acceptance test document (FAT).
- Site acceptance test document (SAT).
- As-built documentation- Electrical, control,Instrumentation & Automation.

Notes:
1. Schematic drawings shall include a comprehensive schedule of the components used in each switchboard, MCC and control panel including details of the type, manufacturer and rating of each component.
2. The external arrangement of each switchboard, MCC and control panel shall show the arrangement of all components including details of panel section, switch and instrument labels.
3. Control and instrumentation loop drawings shall show on a single drawing the complete circuit associated with an instrument or device including details and location of power supplies, cabling and terminations.
4. Hook up drawings shall detail how an instrument or device is installed.

Instrumentation, Electrical control schematics, loop diagrams and schedules shall where practical be A3 size drawings; all other drawings shall be A1 size.

(g) Mechanical Building Services

Drawings:
- Single line schematics for wastewater system and drainage systems;
- General arrangement drawings showing the location of each mechanical building service plant item;
- General arrangement of ventilation systems;
- Fixing details.

Schedule:
- Plant data sheets with Equipment GA dimensional drawing, Foundationdetail, Calculation and Manufacturer's Quality Assurance Plan.
- Pipeline schedules.
- Valveschedules.

Calculations for:
- System & Equipment sizing.

The Engineer reserves the right to ask for additional Equipment/system information apart from the above to ascertain good system design and proper selection of Equipment.

3.16.6 As-Built Drawings

These drawings shall be compiled by the Contractor and shall constitute a permanent record of the Works as executed. These shall include all such drawings, schedules, documentation and calculations as necessary for a complete understanding of the Works design, operation and maintenance.

The As-Built Drawings shall consist of the fully up-dated versions of the approved Construction Documents incorporating any additional information which will assist the Employer in operating, maintaining and if necessary modifying or extending the Works at a later date. These drawings should extend and supplement the information given in the Operating and Maintenance Manuals.

A3 and smaller sized As-Built Drawings shall be provided on durable paper for reproduction by photocopier. As-Built Drawings larger than A3 sized shall be provided as a paper copy and also produced in the form of black lines on a durable translucent film from which further paper prints can be taken by others as required. In addition, drawings shall be provided as an AutoCAD (latest revision) software copy in editable form in Compact Disc (CD) in twosets.
Text shall be provided in an industry standard word processing, spreadsheet or database format as appropriate (Editable copy).

3.17 Operating and Maintenance Manuals

3.17.1 General

The Contractor shall compile operating, maintenance and overhauling instructions for the whole of the Plant.

The instructions shall consist of one volume of:

(a) General descriptive text (including drawings for illustration) of the Works described section by section.

(b) Complete operational instructions for the sewage treatment plant. This shall be termed the Operators Manual. It shall be aimed at the operational staff and shall be written in clear unambiguous text complete with drawings which necessary for clarification of any issues. The manual shall comprehensively detail what to do on a day-to-day basis and also what to do in the event of faults develop. It shall in addition provide a complete list of the process maintenance tasks the operator should carry out including the intervals between these tasks.

(c) Essential instructions for mechanical and electrical maintenance of the Plant. These instructions shall be short and concise and set out in a consolidated schedule the inspection, lubrication, cleaning and any other type of servicing operations required. The Contractor shall prepare typical maintenance log sheets that the Employer can subsequently use for daily, weekly, monthly or other periodic maintenance and shall form record sheets of plant maintenance operations.

(d) Instructions for use of skilled maintenance personnel in fault location, carrying out routine replacements, withdrawing, dismantling, overhauling, re-assembling and testing the various items of Plant.

(e) Manufacturer's Technical Documentation subdivided into categories for:
- Civil.
- Process.
- Measurement against Inflow load fluctuations.
- Deterioration of treated water due to bulking.
- Other trouble shooting.
- Managing Index for process operations.

- Electrical.
- Electrical building services.
- Mechanical building services.
- Instrumentation and control.

(f) Civil As-Built Drawings.

(g) Comprising the FDS and PLC code.

(h) Electrical As-Built Drawings: The electrical drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(i) Control and instrumentation As-Built Drawings: The drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(j) Mechanical As-Built Drawings: The mechanical drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(k) Electrical and mechanical building services As-Built Drawings: The drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(l) FAT records for the Plants and Works.

(m) SAT records for the Plants and Works.

Each volume shall be subdivided (relating to areas of plant) into sub sections or sub-volumes in order to ease the location of plant details. Each volume or sub volume shall be provided with a comprehensive index for the volume or sub-volume concerned and the O & M manual as a whole.

Each volume shall be enclosed within A4 and A3 ring binders having tough grease resistant covers suitable for use on site and designed to permit the easy removal and insertion of the contents. The front cover and spine of each volume shall show details of the project, Employer, Engineer and a volume title.

Text shall generally be enclosed in A4 ring binders, A3 drawings shall be enclosed within A3 ring binders except where they accompany A4 text in which case they shall be folded. A1 drawings shall generally be folded and enclose in A4 box files. Where A1 drawings accompany text they shall be folded and enclosed in an A4 plastic wallet, one wallet per drawing.

3.18 Submission of Documents and Drawings

The Contractor shall supply to the Engineer 7 (seven) copies each(Hard copy & Soft copy) of the drawings and design calculations for the process and sizing of all components of the System including architectural, structural, mechanical, electrical and instrumentation equipment, supported by flow diagrams and general arrangement drawings for approval. It may be noted that soft copies of the AutoCAD sewer network drawings will be provided and contractor shall supply drawings as detailed above.

The Engineer may require the Contractor to submit for approval additional drawings if they are necessary to enable him to satisfy himself that the items are well designed, that they comply with the Employer's Requirements and that they are suitable for their intended purpose. These drawings shall form the agreed basis for the execution of the Works. If an approved drawing is revised, revised copies shall be submitted for approval as above and no such revised drawing shall be used for the purposes of the Contract until it has been approved in place of the earlier issue of the drawing.

The Employer shall arrange to send observations if necessary within 28 (twenty eight) calendar days of submission of the design and drawings for modifications to the Contractor. The Contractor shall incorporate all necessary comments of the Engineer in the above design and drawings, if any, and

shall re-submit further 5 (five) copies each (Hard copy & Soft copy) of the revised designs and drawings within 10 (ten) days for final approval of the Engineer. The Contractor shall thereafter submit 8 (eight) copies each of the approved designs and 8 (eight) copies each of the approved drawings together with one copy each of the reproducible tracings. The Engineer will return 2 (two) approved copies to the Contractor and retain 6 (six) for the Engineer's office and field use.

If the submissions require more than one round of revision on account of incomplete compliance from Contractor, the delay will be on account of the Contractor. If new observations are given by the Engineer, the Contractor will be entitled to take an additional 10 (ten) days period for compliance.

The Engineer will signify his approval or disapproval of the Preliminary Phase Drawings / Construction Documents within 28 (twenty eight) calendar days of each submission.

The structural designs shall be submitted along with STAAD files (input and output).
The Construction Documents are certified Drawings submitted by the Contractor to the Employer or Engineer during the course of the Contract for approval. Construction Documents shall be submitted in accordance with the timetable set down in the Work Programme.

Approval of drawings by the Engineer shall not be held to relieve the Contractor of his responsibilities under the Contract.

The construction drawings shall be submitted in A3/A1 sized drawing papers and to readable scale.

The Engineer will not permit construction to start on a part or section of the Works unless Construction Documents for that part or section have been approved.

Draft copies of the O & M Manuals shall be submitted to the Engineer for his approval at least 56 (fifty six) calendar days prior to the commencement of Tests on Completion.

The Engineer will signify his approval or disapproval of the O & M Manuals within 28 (twenty eight) calendar days of submission.
Draft As-Built Drawings shall be submitted 56 calendar days prior to the commencement of Tests on Completion.

The Engineer will signify his approval or disapproval of the As-Built Drawings within 28 (twenty-eight) calendar days of submission.

The Final As-Built Drawings shall be submitted prior to the issue of any Taking Over Certificate.

To remove doubt the submission dates referred to above shall be the dates on which the drawings and documents are received by the Engineer.

3.19 Notice of Operations

The Contractor shall give full and complete written notice of all important operations to the Engineer sufficiently in advance to enable the Engineer to make such arrangements as the Engineer may consider necessary for inspection and for any other purpose. The Contractor shall not start any important operation without the written approval of the Engineer.

3.20 Protection of Existing Installations

The Contractor shall apply to the Engineer in writing at least 28 days before starting any work that involves interference with existing structures, equipment, etc. The Contractor shall not execute such work until he has received permission to proceed, in writing from the Engineer.

The Contractor shall ensure that no earth, debris or rock is deposited on public or private roads or rights of way as a result of the Works and all vehicles leaving the Site shall be cleaned accordingly.

3.21 Protection of Existing Public and Private Services

The Contractor shall notify all public authorities, utility companies and private owners of proposed works that will affect them not less than two weeks before commencing the works.

The Contractor shall adequately protect, uphold, maintain and prevent damage to all services and shall not interfere with their operation without the prior consent of the public authorities, utility companies, private owners, or the Engineer as appropriate.

If any damage to services results from the execution of the Works, the Contractor shall immediately:

(a) Notify the Engineer and appropriate public authority, utility company or private owner.

(b) Make arrangements for the damage to be made good without delay to the satisfaction of the public authorities, utility company or private owner as appropriate. The Contractor shall be liable for all costs for making good such damage.

The Engineer may issue instructions or make other such arrangements as he deems necessary, to repair rapidly any essential services damaged during the execution of the Contract. Such arrangements shall not affect any liability to pay for making good the damage.

3.22 Reinstatement and Compensation for Damage to Persons or Property

The Contractor shall reinstate all properties whether public or private which are damaged in consequence of the construction and maintenance of the Works to a condition as specified and at least equal to that obtaining before his first entry on them.

If in the opinion of the Engineer the Contractor shall have failed to take reasonable and prompt action to discharge his obligations in the matter of reinstatement, the Engineer will inform the Contractor in writing of his opinion, in which circumstances the Employer reserves the right to employ others to do the necessary work of reinstatement and to deduct the cost thereof as certified by the Engineer from any money due or which shall become due from the Employer to the Contractor.

The Contractor shall refer to the Employer without delay all claims, which may be considered to fall within the exceptions listed in the Conditions of Contract.

3.23 Packing and Protection

Before any Plant is despatched from a manufacturer's factory it shall be adequately protected and packed to ensure that it will arrive on the Site in an undamaged condition. The methods employed for

protection and packing must be suitable for withstanding the conditions which may be experienced during shipment, delivery to the Site and prolonged periods of storage in the open, whether the items are shipped in packing cases, crates or only partially protected according to their nature.

Bright parts and bearing surfaces shall be protected from corrosion by applying a rust preventive lacquer, high melting point grease or similar temporary protection. A sufficient quantity of solvent shall be supplied with the plant to enable this coating to be removed on the Site.

All machined flanges and other mating surfaces shall be protected by means of wood templates. The bolts for securing these templates shall not be reused in the final installation.

No one crate or package shall contain items of Plant intended for incorporation in more than one part of the Works.

All items of Plant shall be clearly marked for identification against the packing list, which shall be placed in a waterproof envelope inside every packing case or crate.

Every packing case and crate shall be indelibly marked to show its weight, serial number, top and bottom, shipping marks and handling instructions or sling marks.

Electrical Plant shall be enclosed in sealed airtight packages with dehydrating material, before being placed in packing cases on shock-absorbent material and secured by means of battens.

3.24 Quality Assurance

3.24.1 Policy

In accordance with Clause 4.9of the Conditions of Contract the Contractor shall apply the formal requirements of Quality Assurance to the design, supply, construction and maintenance of the Works. This shall be achieved through the implementation of a Quality System compliant with the requirements of BS 5750 or an equivalent International Standard.

Positive commitment to Quality Assurance shall be expressed in a formal policy statement given in the Contractor's Quality Manual.

3.24.2 Objectives

It shall be the stated aim of the Contractor to achieve and demonstrate the achievement of quality as expressed by `due care and diligence' of the design, supply, construction and maintenance of the Works as defined by the Employer's Requirements.

The criteria to define `due care and diligence' shall be explained in the Contractor's Quality Plan and shall embody all of the design, supply, construction and maintenance requirements of the Works.

3.24.3 Quality System

The Quality System shall be fully integrated for all of the Works.

This system will be defined by the organisational structure, responsibilities, activities, resources, and events that together demonstrate the capability of the Contractor to meet the stated quality requirements.

The Contractor shall ensure that all Sub-Contractors and sub-consultants establish quality systems and shall supply to the Employer such evidence as is necessary to demonstrate the effective implementation of a quality system in each sub-contractor or sub-consultant organisation.

The Quality System of the Contractor and of his Sub-Contractor and sub-consultants will be subject to periodic audits undertaken by the Engineer. The Engineer will give two weeks' notice of such audits that will involve a full assessment of the performance and efficiency of the Quality System and will include review of the feedback and records derived from the Contractor's monitoring and internal reviews.

On a day-to-day basis the Contractor shall afford reasonable availability of staff and documentation for the Engineer to assess the implementation of the Quality System. The Contractor shall ensure that all relevant personnel and documentation are available for such audits.

3.24.4 Quality Plan

The implementation of the Quality System shall be through the establishment of a comprehensive Quality Plan issued to and approved by the Engineer.

The documented procedures shall include but not be limited to:

- Management Procedures.
- Design.
- Supply/Procurement.
- Construction.
- Putting to work/Commissioning/Reliability Trial/Performance Test witnessing the test and review.
- Operator Training and Maintenance.
- Interface Control.
- Quality Performance, Monitoring and Review.

There shall be procedures to control transmission of information across all interfaces both internally (that is, within the Contractor's Quality System) and externally. Those of the latter shall include all Statutory Bodies, Authorities and the Engineer.
Formal assessment of any non-compliance with the Quality Plan shall be achieved through periodic reviews undertaken by a team appointed by the Contractor. All deficiencies shall be recorded and appropriate corrective measures shall be assessed, within an appropriate timescale, through subsequent formal reviews undertaken by the Contractor.

3.24.5 Quality Feedback

The system shall include for the reporting back, recording and incorporation into the system of deficiencies and remedial measures to correct them noted during the control of the project.

3.25 Environmental Protection

The Contractor shall minimize, as far as is practically possible, the effects of all his and his Subcontractor's activities upon the environment and shall implement and monitor measures to prevent:

(a) Contamination of surfaces, ground, groundwater, surface water and rivers.
(b) Emissions to air, including smells, gases, smoke and dust.
(c) Unsanitary or unsafe storage or discharge to drain, sewer and surface waters.
(d) Unsanitary or unsafe storage or discharge of solid wastes.
(e) Noise.
(f) Visual intrusion and
(g) Excessive energy and water consumption.

These requirements shall be met through the constant and careful attention of the Contractor's management of all Site and off-site activities, and by instruction to all staff and labour in these matters.

Implementation shall include for monitoring and reporting on the results of the above measures. Monitoring reports shall be in writing and submitted on a monthly basis as part of the monthly report referred to above. The report shall include a listing and summary of daily monitoring results on all aspects listed above.

All potentially affected areas of the Site, other areas used for or affected by the works and all adjacent or affected waterways shall be monitored and, where instructed by the Engineer, tested.

3.26 Safety

The Contractor shall prepare a Safety Plan and submit the same to the Engineer for approval within 28 days of receiving the Notice to Commence.

The Safety Plan shall be followed at all times by the Contractor and shall contain adequate control measures, in accordance with the relevant protection of property and local laws and regulations as well as internationally accepted good practice, for the prevention of accidents, fires and public nuisance.

The Safety Plan shall be implemented properly and diligently throughout the execution of the Works and during the operations and maintenance period.

The Contractor's Safety Plan shall make safety provision for, among other things:

(a) Deep excavations and collapsing sides in trench excavations.
(b) Scaffolds and overhead working.
(c) Working in confined spaces.
(d) Working in water.
(e) Contractor's Equipment, especially cranes, heavy vehicles, etc.
(f) Hand held power tools.
(g) Electrical equipment, power connection.
(h) Hazardous chemicals, gases and fuels.
(i) The use of protective clothing and
(j) The provision of first aid facilities.

On-Site Patrol

- The Safety Manager patrols everyday (preparation of report & announcement in morning meeting)
- Surprise inspection by Engineer
- Regular safety exercise
- Morning meeting every day

- The Contractor shall at all times in the conduct of his work and that of his Subcontractors adhere to the established rules and regulations concerning all safety matters at Site such as the recommendations contained in the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, Inc., or other Internationally recognized recommendations to the extent that such provisions do not conflict with the applicable laws. This is especially important wherever it is necessary to enable the free passage of the public through the Site.

The Safety Plan shall be developed to ensure zero fatal accidents and zero hazardous incidents/occurrences in all construction works. The Safety Plan shall include descriptions of the company's standard policies and procedures regarding its site organization and procedures, methods and frequency of conducting safety audits at the Site(s), record keeping and reporting, providing safety training for its personnel (including subcontractors), issue and mandatory use of safety equipment, and details of the qualifications and experience of the Bidder's proposed safety officers to be deployed at the Site(s). The Contractor shall provide separate descriptions in its Safety Plan covering the construction phase and the subsequent operations and maintenance phase.

- The Contractor shall appoint a full time Expert/ Health and Safety Engineer/Manager (Accident Prevention Officer) having the required qualifications and experience in this field, who shall be responsible for implementing the Safety Plan. He should have the authority to issue instructions to the Contractor's personnel regarding protection measures to prevent accidents.

- The Contractor shall provide the public with adequate information on all risks with respect to the construction works. If the general public sustains any kind of bodily injury or death, the Contractor shall be responsible for providing all necessary medical care and compensation.

The Contractor shall ensure that his staff and labour and his Subcontractors are all fully trained in and aware of good and safe working practices.

The Contractor shall ensure that all precautions are taken to safeguard the generalpublic and construction/operating staff from any danger.

- During construction the Contractor shall erect, maintain and subsequently remove sufficient barricades, guards, lighting, sheeting, shoring, temporary sidewalks and bridges, danger signals as well as temporary covering of potential accident areas, as approved by the Employer. All temporary and partially completed works shall be protected by way of barriers, lights, notices and the like. All excavations and the like are to be protected by barriers at all times and adequately illuminated at night. Adequate number of Life buoys are to be provided near water retaining structures with depth more than 1.2m during construction and Operation & Maintenance stage.

- All open excavations along pipe lines shall be protected sufficiently to keep out livestock, and ensure the safety of workmen and members of the public and be in accordance with the directives of the police and the other local regulations.
- The Contractor shall be responsible for ensuring that all persons working in the vicinity of power lines are aware of the relatively large distance that high voltage electricity can "short" to earth when cranes or other large masses of steel are in the vicinity of power lines.
- Where work is to be carried out in the proximity of buildings, bridges, tanks or other structures, the Contractor shall take all necessary precautions, including shoring and strutting, where necessary, to ensure the safety of the structures that are at risk.
- The Contractor shall be responsible for all damages or injury which may be caused on any property by trespass by the Contractor's or his Subcontractor's employees in the course of their employment, whether the said trespass was committed with or without the consent or knowledge of the Contractor.

Warning and diversion signs concerning roadwork shall be suitably placed to give motorists ample warning. During the movement of heavy vehicles across roads or onto roads, men, bearing red flags, shall be in attendance to warn other road users and to generally control traffic in a safe manner.

The Safety Plan shall also consider requirements for warning and protection for other risks including overhead and underground cables, pipes or obstructions, or voids, openings, pits and trenches. The Contractor shall ensure that all appropriate measures are implemented.

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1 (¼ horizontal and 1 vertical).
2. Scaffolding of staging more than 3.6 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. high above the floor, or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is

more than 3.6 m above ground level or floor level, they should be closely boarded; should have adequate width and should be suitably fastened as described in (2) above.

4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m. in length while the width between side rails in rung ladder shall in no case be less than 29 cm. for ladder up to and including 3 m. in length. For longer ladders this width should be increased at least 6 mm for each additional 30 cm. of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident. The Contractor shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit, action or proceedings to any such person.

6. Excavation and Trenching - All trenches 1.2 m. or more in depth, shall always be supplied with at least one ladder for each 30 m. in length or fraction thereof. Ladder shall extend from bottom of the trench to at least 90 cm. above the surface of the ground. The sides of the trenches which are 1.5 m. or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m. of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

7. Demolition - Before any demolition work is commenced and also during the progress of the Work,

    i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

    ii) No electric cable or apparatus which is liable to be a source of danger or cable or apparatus used by the operator shall remain electrically charged.

    iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Employer should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned.

The following safety equipment shall invariably be provided.

    i) Workers employed on mixing asphalt materials, cement and lime mortars shall be provided with protective footwear and protective goggles.

    ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes shall be provided with protective goggles and nose masks.

iii) Those engaged in welding works shall be-provided with welder's protective eye Shields, nose mask & gloves.

iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public, in addition, the contractor shall ensure that the following safety measures are adhered to:

a) Entry for workers into the line shall not be allowed except under supervision of the Engineer.

b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.

c) Before entry presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.

d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit and self-contained breathing apparatus (SCBA).

e) Double lanyard safety harness with shock absorber and rope should be provided to the workers. While working inside the manholes such rope should be handled by two men standing outside with pulley system to enable him to be pulled out during emergency conditions.

f) The area should be barricaded or cordoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.

g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.

h) The malba (solid waste) obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.

i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer may decide the time up to which a worker may be allowed to work continuously inside the manhole.

j) Self-contained breathing apparatus (SCBA) and first aid should always be present at site for use in any emergency.

k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 meters away from the opening and on the leeward side protected from

wind so that they will not be a source of friction on any inflammable gas that might be present.

l) The workers engaged for cleaning the manholes/sewers should be properly trained in "Confined Space" before allowing working in the manhole.

m) The workers shall be provided with Gumboots or non sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.

n) Workmen descending a manhole shall try each ladder stop or rung careful before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.

o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.

p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer regarding the steps to be taken in this regard in an individual case will be final.

vi) Contractor shall be fully responsible in the event of death of employee/workmen during the execution of the work and liable to pay adequate compensation to the dependants of employee/workmen as per law. On his/their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amount due to the contractor or by appropriate legal action. If death of any employee occurs during execution of work due to negligence of contractor, the contract may be liable for termination.The Board will be entitled to claim exemplary damages from the contractor in case of death of any workman/employees of the contractor in any of the BWSSB works as it damage the reputation of the Board.

vii) The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:-

a) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.

b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scraped.

c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work

d) White lead, sulphate of lead or product containing this pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.

i) Measures shall be taken, wherever required in order to prevent danger arising from the application of paint in the form of spray.

ii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.

iii) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

iv) Overalls shall be worn by working painters during the whole of working period.

v) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.

vi) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of BWSSB.

vii) BWSSB may require when necessary medical examination of workers including measuring blood lead levels.

viii) Instructions with regard to special hygienic precautions to be taken in the painting.

9. When the work is done near any place where there is risk of drowning, all necessary equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the work.

10. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:

    i. These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

    ii. Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent detects.

    iii. Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

    iv. In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

    v. The Contractors shall notify the safe working load of the machine to the Employer-in-charge whenever he brings any machinery to site of work and get it verified by the Electrical Employer concerned.

11. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energized, insulating mats, wearing apparel, such as. Gloves,

sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.

All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

12. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.
13. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Employer-in-Charge of the department or their representatives.
14. Notwithstanding the above Clauses from (1) to (13) there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force In the Republic of India.

3.26.1 Additional Safety Guidelines

Following guideline /instructions should be adhered to in true spirit:-

1. The door may be fixed at the entry of the stair case and the open portion of the stair case of sump well should be protected by grill up to the height of 7 feet and compartments of the sump well should be covered with jallis/grating or should be barricaded property. Sewage pumping station should be secured by providing and fixing barbed wire fencing over the boundary wall.

2. An inspection register should be placed at the sewage pump house in which all the inspecting officers may record their observations. No unauthorized entry should be allowed.

3. Caution board showing the restricted entry area and name of components and moving mechanical part should be displayed.

4. The entry to all BWSSB infrastructures should be restricted to the person /persons authorized by BWSSB or having I.D cards issued by the chief security officer.

5. Just after entering the premises do's and don'ts should be displayed at prominent places in all three languages.

6. Even authorized visitors should be provided proper uniform /visitor badges helmet and relevant safety gear and given instruction before showing such infrastructure.

No person below 18 years age should be allowed on the premises where chances of emission of toxic gases are extensive.

3.26.2 National Human Rights Commission (NHRC) Guidelines

NHRC issued guidelines on safety code for operation/maintenance of sewerage system has to be strictly followed during execution of work. Direction given by Hon'ble Supreme Court in the matter of National Campaign for Dignity & Right of Sewerage & Allied workers.

1. The medical examination and medical treatment will be given free of charge to sewer workers and the treatment will continue for all such workers found to be suffering from an occupational disease, ailment or accident until the workman is cured or until death.
2. The services of the sewer workers are not to be terminated, either by the respondents or the

contractors engaged by them during the period of illness and they shall be treated as if on duty and will be paid their wages.

3. The respondents shall pay on the death of any worker including any contract worker, an immediate ex-gratia solatium of One lakh with liberty to recover the same from contractors, if permissible in law.
4. The respondents shall pay/insure payment of all statutory dues such as Provident Fund, Gratuity and Bonus to all the sewer workers including contract workers, as applicable in law.
5. The respondents shall provide as soon as possible modern protective equipment to all the sewer workers in consultation with the petitioner organization.
6. The respondents shall provide soap and oil to all the workmen according to the present quota but on monthly basis and not at the end of the year.
7. The respondents shall provide all workmen including contract workmen with an accident-card-cum-wage-slip.

3.26.3 Protection of Overhead and Underground Services

- The Contractor will be held responsible for any damage to known services (i.e. overhead services that are visible within the Site and underground services shown on the drawings) and he shall take all necessary measures to protect them. All work or protective measures shall be subject to approval of the Employer. In the event of a service being damaged he shall inform the Employer and the authority concerned, the Contractor shall not repair any such service unless instructed to do so.
- Contractor will map the underground utilities. Where no underground services are shown on the drawings or scheduled but the possibility of their presence can reasonably be inferred, the Contractor shall, in collaboration with the Employer, ascertain whether any such services exist within the relevant section of the Site. The Contractor shall complete such an investigation well in advance of the start of construction work in the said section and he shall submit a report in good time to enable the Employer to take necessary actions.
- In main roads and junctions, irrespective of utility services indicated in the drawing, the Contractor need to take proper care prior to commencement of Construction activities so as to ensure minimum disruption to the services. This may require even making a cross sectional trail pit to determine the exact alignments of different utilities.
- Taking care of other utility services infrastructure during the execution of the works is the responsibility of the Contractor. Nothing in the Contract should relieve the Contractor from his responsibility towards safety of other utility services infrastructure during project execution. The Contractor's Construction program should include such activities into consideration and no extra claim towards time of completion and cost in this regard shall be entertained.
- As soon as any underground service not shown on the drawings is discovered, it shall be deemed to be a known service and the Contractor will be held responsible for any subsequent damage to it.
- Where the authority concerned elects to carry out on its own account any alterations or protective measures, the Contractor shall co-operate with and allow such authority reasonable access and sufficient space and time to carry out the required work.

The Safety Plan shall include a policy statement signed by the CEO or equivalent authority of the Organization declaring that safety and loss prevention shall be given the highest practicable priority in all aspects of the Contract. The Safety Plan shall be updated as necessary to cover the activities to be undertaken for operations and maintenance.

End of Part-3